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Locator® attachment system for implant overdentures: a systematic review

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SUMMARY

Objective. To evaluate the success rate, complications, maintenance and patient satisfaction with implant-supported overdentures with the Locator® system, by means of a systematic review.

Materials and methods. PICO approach was used to formulate the clinical question. Research was conducted in primary (PubMed® and B-On®) and secondary (Cochrane®) information sources using different logical combination strategies of text words and MESH terms. Articles were selected according to research theme and scientific level evidence.

Results. 55 articles were found. After reading the title and summary, and evaluating the article's level of scientific evidence, only ten were included for analysis. Eight studies were related to rehabilitations in the mandible and two were bi-maxillary. The analysis of the studies showed that complications and type of maintenance are primarily related to the loss of retention and the need to replace the nylon male component of the system. Patient's satisfaction was highlighted in five articles of this research.

Conclusion. The overall satisfaction rates of patients seem to indicate this system as a viable clinical option of prosthetic rehabilitation. Overdentures with the Locator® system appear to hold a good retention, either in the upper or lower jaw, but require frequent maintenance visits, due to complications observed in these prosthodontic rehabilitations.

Key words: prosthodontics, overdentures, denture precision attachment.

INTRODUCTION

According to recent UN data, the increasing number of elderly patients in the population, especially in Western countries, is a certain reality for the future. In Portugal, it has been predicted that the percentage of the population over 60 years old could rise from 24% in 2011 to 40% by 2050 (1, 2).

This specific age group requires special attention in health care since they exhibit physiological and anatomic constraints associated with their age. Specifically in the field of dentistry, these patients often have notable difficulties in using the conventional complete denture due to lack of retention, support and stability, resulting in reduced chewing efficiency. To overcome these problems and allow a better oral-health related quality of life, one of the treatment options that is currently performed and accepted by patients is an implant-supported (retained) rehabilitation (e.g. mandibular overdenture retained by two implants) (3-5).

In the last two decades, the use of prosthetic retention systems in dental implants has achieved good results in edentulous patients, significantly increasing their satisfaction and prosthetic rehabilitation results (6). The scientific literature does not establish a limit to the value of retentiveness strength to apply since this depends on multiple factors, such as the anatomic constraints of the complete denture support area, or the patient's ability to insert/remove the denture (7, 8).

Retention strength is obtained through mechanical contact (e.g. friction, magnetic) between an element retained in the implant and another element placed in the prosthesis, such as a male/female locking mechanism (9, 10). There are different attachment systems on the market differing in their shape and material, the most popular being retention bars and individual "ball-type" attachments (11).

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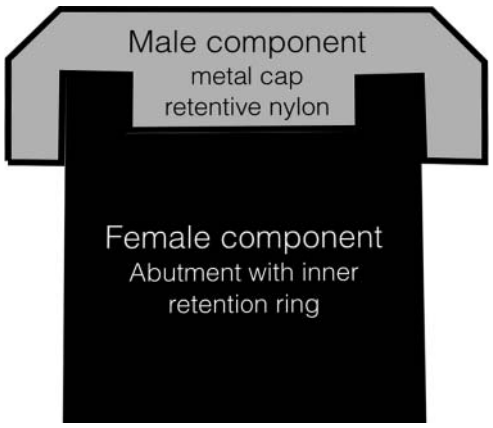

Fig. 1. Schematic design of the Locator® system components (Zest Anchors)

Attachment system selection usually depends on the working experience of the dentist and their dental technician. Few studies have been undertaken to compare these systems in order to provide dentists with clinical evidence to help them reach the best clinical decision (12).

In 2001, Zest Anchors Company® launched one of the most popular attachment systems, namely the Locator attachment system (Figure 1), with an optimized design aimed at improving the retention and stability provided by ball-type attachments. This system consists of a patrix (male part) and a matrix (female part), using a dual retention approach with different retentive values. It is classified as a resilient universal hinge device, and is designed for limited inter-arch distances, enabling inter-implant angles to be fixed up to 40º (13-15).

The retention value of the Locator attachment depends on the patrix, composed of a metallic cap with a replaceable nylon element, and its cross-sectional strength is obtained through its dual retention feature (inner and outer). This attachment employs mechanical and frictional forms of retention, since the insert section of the nylon male component is slightly oversized compared to the inner ring of the female abutment. The external margin attaches simultaneously and completely within the shallow area at the outer margin of the abutment, while the central stud of the nylon male component insert press-fits inside the inner metal ring of the female abutment. In cases of implant angulation correction, the nylon components of the Locator system do not have studs for inner retention in the abutment (7, 16, 17).

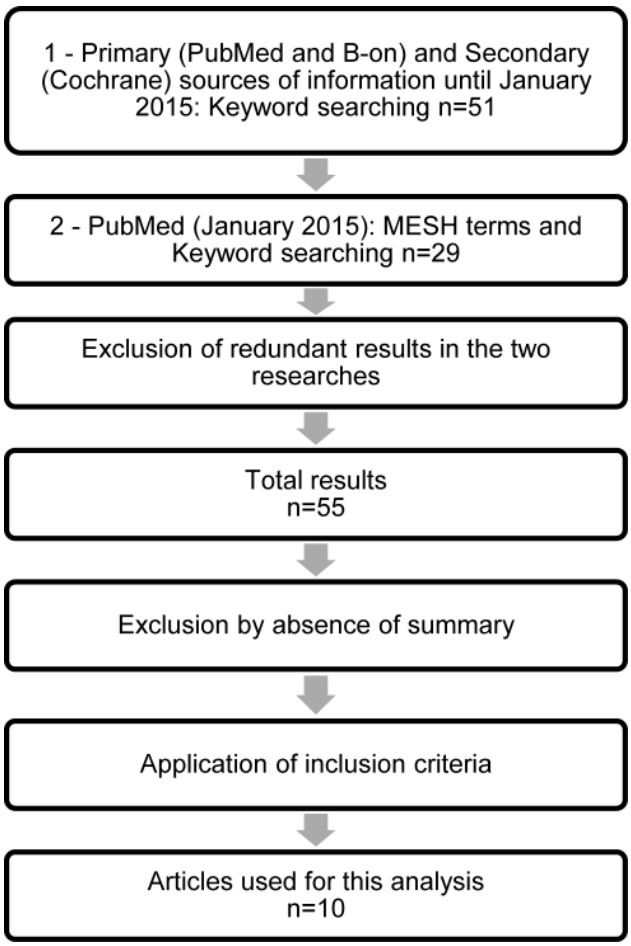

Fig. 2. Flow diagram of the search strategy

Even though this system seems to have been well accepted by the Dental Medicine community, there is a lack of scientific literature providing clinical evidence of its long-term clinical benefits (18).

The present research thus aims to examine the literature published regarding the Locator retention system®, using the results evaluated to assess its success rating, level of satisfaction, complications and type of maintenance required.

MATERIAL AND METHODS

PICO (Population, Intention, Comparison, Outcomes) approach was used to formulate the following clinical question with precise inclusion criteria (19): in edentulous adult patients (P), rehabilitation with overdentures on implants with Locator attachments (I), in comparison with other systems, can provide better

Table 1. Research strategy used and results obtained

Keyword Searching	MESH terms & Keyword searching
• "locator retained overdentures"	• "Denture Precision Attachment"[Mesh] AND "Dental Implants"[Mesh] AND locator
	• "Denture, Overlay"[Mesh] AND "Dental Implants"[Mesh]) NOT "Tooth"[Mesh] AND locator

results in terms of success rate, level of satisfaction, complications and type of maintenance (O)?

A study was made of primary (PubMed® and B-On®) and secondary (Cochrane®) sources of information. In PubMed, across the MeSH terms, different strategies were used in order to obtain more information about oral rehabilitations of overdentures with Locator attachments (Table 1).

By using an amalgam of different research strategies, 55 relevant articles were found available. No filtering was used during this research. After reviewing the reported articles, a significance analysis was carried out on paramount studies according to the scientific evidence scale (n=10).

The following inclusion criteria were used to select articles for inclusion in this paper:

- Meta-analysis articles and systematic revisions.
- Controlled randomized clinical tests articles and Coorte studies.
- Containing reference to overdentures with Locator attachment compared with other retention systems.
- Containing reference to success rate, level of satisfaction, complications and maintenance.

Table 2. Summary of articles obtained in the systematic review

Study	Design	Nº Patients	Maxilla/ Mandible	Referred complications	Considerations for maintenance	Patient satisfaction
Kleis *et al.*	RCT	60	Mandible	Retention loss due to deformation and deterioration of the nylon (male component).	Annual follow-up appointments.	NR
Alsabeeha *et al.*	RCT	36	Mandible	Plaque accumulation and food debries within Locator® system.	Need to replace the nylon Locator® system periodically.	NR
Alsabeeha *et al.*	PS	36	Mandible	Nylon component of the Locator® system with great deterioration and plastic deformation, loss of retention, metal box with plaque accumulation.	NR	
Cheng *et al.*	RCT	15	Mandible	NR	NR	Increase satisfaction scores of patients with overdentures retained by Locators® or magnetic fittings (with no statistically difference between the systems).
Krennmair *et al.*	RCT	20	Mandible	Lack of support and stability of dentures base (need to reline).	Need to replace the nylon Locator® system periodically.	Excellent overall satisfaction.
Vere *et al.*	PS	50	Maxilla e Mandible	More complications in maxillary overdentures compared to mandibular (eg. lack of retention).	High number of maintenance appointments, to solve simple problems.	NR
Akca *et al.*	PS	29	Mandible	Retention loss due to deformation and deterioration of the male component nylon.	NR	NR
Malmstrom *et al.*	PS	45	Mandible	NR	NR	Increased satisfaction with overdentures retained by implants with Locator® system.
Troeltzsch *et al.*	PS	33	Maxilla e Mandible	Loss of retention. Fracture of prosthetic teeth (1:10) and fracture of acrylic base.	Nylon component replacement to compensate retention loss.	High rates of satisfaction without differentiating maxillary overdenture of mandibular overdenture.
Geckili *et al.*	PS	55	Mandible	NR	NR	Immediate holding force provides a better quality of life, but does not affect patient satisfaction.

RCT: Randomized Controlled Trial; PS: Prospective study; NR: Not recorded.

As exclusion criteria:

- Reports of clinical cases, experimental studies and papers with no abstract.

RESULTS

A total of 55 articles were discovered as the result of various different research strategies. Two of them were excluded due to the absence of an abstract. After reviewing the abstracts, according to the above mentioned inclusion criteria, it was found that only ten of them fulfilled the pre-established requirements (Figure 2).

Based on the scientific evidence, four were randomized controlled studies (20-23) and six were prospective clinical studies (11, 18, 24-27).

Of the ten articles considered (Table 2), eight of them refer to studies using overdentures retained by Locator attachments in the mandible and the other two studies (18, 26) were related to both jaws.

We also found that seven of the articles selected report complications identified with this type of rehabilitation, five of which (11, 18, 20, 23, 27) refer to complications related to lack of retention in the Locator systems. One of the studies even mentions that following insertion, the Locator system requires more care to the retention activation level than "ball-type" attachments (21). Regarding this issue, other authors report more complications in maxilla overdentures compared with those in mandibles (26).

Six of the ten studies selected (11, 18, 21, 23, 26-28) report on the maintenance related to this kind of rehabilitation, specially concerning loss of retention and the nylon replacement of the Locator system's male component (11, 18, 21, 27, 28). This corresponds with Kleis *et al.* (23) whose randomized controlled clinical study reaches the conclusion that an annual follow-up for patients with this retentive system is extremely necessary. Vere *et al.* (26) emphasize the fact that this type of rehabilitation is associated with an increased number of maintenance appointments, although with problems easily solved.

Five studies (18, 21, 22, 24, 25) report data regarding the satisfaction of patients subjected to this type of rehabilitation and correlative retentive systems under study, revealing that there is a high level of satisfaction present in all of them.

DISCUSSION

This literature review concerns prosthetic oral rehabilitations with implant-supported overdentures within the Locator retention system, focusing on comparisons with other systems, their use in the maxilla or in the mandible, their complications, maintenance and patient satisfaction.

Although this system is applied quite frequently within the dental community, information sources reveal only a scant number of publications with a high level of scientific evidence. Once the research methodology had been concluded, only ten articles were found from the most recent time period (2010-2013). Four of them (20-23) were randomized controlled clinical studies comparing this type of retentive system with other available ones, while the remaining six articles (11, 18, 24-27) were prospective clinical studies with less scientific evidence than in those reported previously.

According to the literature consulted (11, 12, 18, 20-23, 27), the use of implant-supported overdentures using the Locator system seems to be one of the preferred treatments in cases of edentulous patients with retention problems using a conventional removable prosthesis, especially in the mandible.

Based on data available, the appropriate treatment option for an edentulous maxillary consists of an implant-supported total upper prosthesis retained by at least four edentulous implants with bar, mostly due to the fact that the loss of an implant is considerably higher when the prosthesis is supported by fewer than four implants. Concerning the mandible, the implant-supported overdenture retained by two implants should be the minimum that can be offered to edentulous patients as a first treatment option, since the survival rate in mandible implants is high, regardless of the number of implants (5).

The studies selected in this review meet what is observed in the literature regarding the set number of implants, both in the maxillary and mandible, to achieve these kind of rehabilitations (5).

Complications with such rehabilitations using the Locator system involve loss of retention through visible damage to the nylon male component (11, 20, 23, 27). The remaining studies emphasize the occurrence of fractures in prosthetic teeth (18) and loss of denture margin adaptation in overdentures (21).

In this paper, we also observed that Vere *et al.* (26) report an increased number of problems in maxillary overdentures, compared to those in mandibles, even though the results must be analyzed with special attention, considering the limited number of maxillary overdentures examined.

In order to extend and improve discussion of these results, research was carried out into the literature of many studies of the Locator system (for instance: experimental studies) ignoring the inclusion criteria used in this paper.

Abi Nader (29) shows that chewing activity has reduced the retention ability of the Locator system to about 40% over its initial value, with a non-linear downward trend after 400,000 loads, a number approximately similar to the average number of chewing cycles after a year.

Kleis *et al.* (23) state that the Locator system shows higher maintenance frequency, due to nylon's high rate of deformation and damage. These results are similar to those shown by another study (20) which indicated that its main concern about the Locator system compared to other retentive systems is its need for replacement in a reduced time-frame. An advantage in terms of achieving greater retention ability in the system is that the toughness of the male component can also transmit an increased charge to the implants, though without any clinical relevance. That is the conclusion drawn from the research done by Assad *et al.* (30) and Gonda *et al.* (31) which point to this situation as a disadvantage of this system compared to a magnetic system, which is less resistant to lateral forces and, therefore, causes lower peri-implant tension.

According to Troeltzsch *et al.* (18), an increased number of implants to support the overdenture seems to reduce the number of prosthetic complications, as well as the deterioration of the male component of the Locator system, despite the increased complexity in laboratorial execution of the rehabilitation due to eventual implant discrepancies. These results are similar to those observed in the literature (32-35). In opposition to the excellent long-term success and survival rates, both in implants and prosthesis, several studies have described how in in mandible overdentures an increased number of implants and prosthetics are lost due to jawbone overdentures (5).

Experimental studies (29, 36-39) compare the Locator retention with other attachment systems, the effect of the implants angulation in overdenture retention or the deterioration caused in the components of these systems by attachment and disattachment of the overdenture. These variables under review reflect the nature of complications most frequently associated with this system which are connected with the prosthetic maintenance of their components.

Other authors (26) point out that the Locator system is linked to a high number of control appointments. Despite the substantial maintenance requirements, the overdenture complications are usually easily resolved, often involving prosthesis adjustment, inadequate retention or loosening of the pillar. Annual control appointments are, therefore, recommended to check/replace the retentive nylon (23).

One of the studies selected emphasizes the importance of the patients' awareness of the need to practise good hygiene with the Locator system so as to contribute to the success of the treatment and reduce the number of control appointments. It is also reported that mandible overdentures achieve better results than those in the jaw, which is supported by the above mentioned conclusions.

The level of patient satisfaction was evaluated through questionnaires administered to patients, mostly according to an analogic visual scale. Of the four studies (18, 21, 22, 25) that mentioned patient satisfaction it should be noted that, aside from general satisfaction, there are no differences between jawbone and mandible overdentures.

CONCLUSION

Implant-supported overdentures using the Locator retention system appear to be prosthetic rehabilitations with good retention, especially in the mandible. The general satisfaction rates of patients with this retention system seem to indicate it being a viable and interesting clinical option, with the potential for large-scale future expansion in prosthetic oral rehabilitation. Nevertheless, according to one of the few studies that fulfilled the inclusion criteria of this study, the Locator system requires high maintenance frequency, particularly with regard to the nylon replacement of the male component. It is important to consider this point in the information that is given to the patient when planning their treatment using this system. The patient should be properly informed about the need to fulfil the necessary control appointments in order to check oral hygiene and eventual replacement of any retentive elements, as well as the probable need for modification or repair of the prosthetic rehabilitation.

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